

Transmission Planning Workshop

Overview of Western's Current Transmission Planning Activities

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Transmission Planning - North
Loveland, CO

June 21, 2011



Transmission Planning Workshop

AGENDA –

10-Yr Network Study Process

NERC TPL- Study Process

Capital Investment Plan

Transmission Planning Workshop

2011 10-YR Network Load Forecast Study and Process

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Purpose

- Evaluate the steady state load serving capability of the integrated system.
- Identify problem areas due to projected system load growth.
- Allows for inclusion of necessary projects in Capital Investment Plan (CIP).
- Ensure that system development keeps pace with load growth in order to continue serving Preference Power Customers; and Network Transmission Customer.

Study Procedure

- Base Cases
 - 2016 Heavy Winter
 - 2016 Heavy Summer
 - 2021 Heavy Summer
- Criteria
 - System Intact
 - 0.95 p.u. – 1.05 p.u. Voltage
 - 100% Continuous Rating Loading
 - Contingency
 - 0.90 p.u. – 1.10 p.u. Voltage
 - 100% Continuous Rating or Emergency Limit
- Contingency Analysis
 - Monitored Integrated System And Adjacent Area

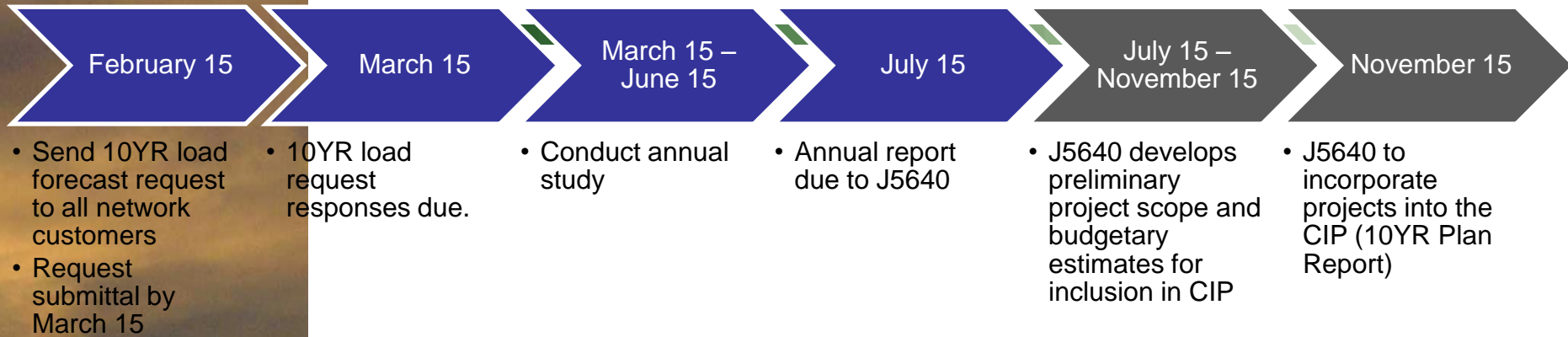
Study Procedure

- TOT 3 (Path 36)
 - Archer to Ault 230 kV
 - Laramie River to Ault 345 kV
 - Laramie River to Story 345 kV
 - Cheyenne to Ponnequin 115 kV
 - Sidney to Sterling 115 kV
 - Sidney to Spring Canyon 230 kV
 - Cheyenne to Ault 230 kV

	TOT 3	TOT 5
2016 HW	1060 MW	690 MW
	1630 MW	940 MW
2016 HS	1850 MW	1040 MW
2021 HS	1850 MW	1015 MW

- TOT 5 (Path 39)
 - Hayden to Archer 230 kV
 - Craig to Ault 345 kV
 - Gore Pass to Blue River 230 kV
 - Hayden to Gore Pass 138 kV
 - Gore Pass 230/138 kV XFMR
 - Gunnison to Poncha 115 kV
 - Curecanti to Poncha 230 kV
 - Basalt to Malta 230 kV
 - Basalt to Hopkins 115 kV
 - Rifle to Hopkins 230 kV

Study Timeline



Load Forecast Data Example

TOWN OR BUS NAME	Bus Number	Bus Name (as in case)	Company Meter Name	Western Meter Name	2009 Summer	2009-10 Winter	2010 Summer
AAAA	#####	ABCD			5,100.00	0.00	5,300.00
BBBB	#####	BCDE			420.68	333.45	443.62
CCCC	#####	CDEF			2,000.00	2,000.00	2,000.00
DDDD	#####	DEFG			13,546.96	1,728.65	10,265.67
EEEE	#####	EFGH			4,378.65	5,246.94	4,425.21

2010 Study Results

PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS/E

AC CONTINGENCY REPORT FOR 4 AC CONTINGENCY CALCULATION RUNS

CONTINGENCY CASE MONITORED BRANCHES LOADED ABOVE 100.0% OF RATING SET A - WORST CASE VIOLATIONS
THRESHOLD FOR THE COUNT OF CONTINGENCIES CAUSING OVERLOADING IS 100.0% OF RATING SET A

X--- MONITORED ELEMENT ----X	X---LABEL--X	2015LS CATB Lo	2015LS CATB Hi	2015HS CATB	2020HS CATB
73021 BGEORGE 69.000 73022 BGEORGE 115.00 1	LV_XFM				105.5% 53MVA (1x)
73021 BGEORGE 69.000 73068 GLENDLTP 69.000 1	LV_XFM			133.8% 38MVA (1x)	201.7% 47MVA (1x)
73068 GLENDLTP 69.000 73082 HEART MT 69.000 1	LV_XFM			111.2% 32MVA (1x)	168.1% 38MVA (1x)
73122 LOVELL 69.000 73123 LOVELL 115.00 1	BGGXFM				122.2% 61MVA (1x)
73150 PEETZ 115.00 73179 SIDNEY 115.00 1	SGC-NYU2			101.9% 110MVA (1x)	
73150 PEETZ 115.00 73191 STERLING 115.00 1	SGC-NYU2			102.9% 108MVA (2x)	111.8% 116MVA (2x)
73179 SIDNEY 115.00 73180 SIDNEY 230.00 1	SGC-NYU2			101.3% 206MVA (2x)	103.4% 210MVA (2x)
73189 STEGALL 115.00 73190 STEGALL 230.00 1	SGXF2			115.8% 116MVA (1x)	126.9% 127MVA (1x)

Results - 2010

- 2015 LS
- No thermal overloads were observed.
- Known low voltage issues were observed at Gering, Wildcat, and Emigrant Substations.
 - For Outages at the Stegall Bus
 - Load Shedding approx 25-60 MW in order to bring voltages back within acceptable emergency levels.

Results - 2010

➤ 2015 HS

- Lovell – Big George 69 kV
 - Study Outcome
 - Loss of Lovell 69/115 kV Transformer
 - » Big George – Heart Mtn. 69 kV Overloads
 - » Big George 69/115 kV Transformer Overloads
 - Loss of Big George 69/115 kV Transformer
 - » Lovell 69/115 kV Transformer Overloads
 - Ideas for addressing overloads
 - Install Parallel Transformers at Lovell and Big George
 - » Minimizes need for rebuilding lines
 - » Prevents thermal violations for N-1
 - String Second Circuit from Big George to Heart Mountain operating at 115 kV on existing double circuit structures
- Sidney – Sterling 115 kV
 - Built: August 1950
 - Caused by Spring Canyon to North Yuma 230 kV contingency
 - Ideas for addressing overload
 - Rebuild Sidney – Peetz – Sterling
 - » Build at 230 kV spacing with 1272 kcmil conductor operate at 115 kV

Results - 2010

➤ 2020 HS

- Lovell – Big George 69 kV
- Sidney – Sterling 115 kV
- Marys Lake Transformer
 - Thermal relay will trip transformer out-of-service if it surpasses a set rating. Allows for service to be provided from Granby 138 kV bus.

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2011 NERC Transmission Planning Studies (TPL-001 thru -004)

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NERC/WECC Transmission Planning

- TPL-001, -002, -003, -004
 - Ensure system is adequate to meet present and future needs
 - Demonstrate through assessment
 - Planning for near and long term
 - Cover all demand levels over range of forecast demands
 - Include existing and planned facilities
 - Ensure adequate reactive resources

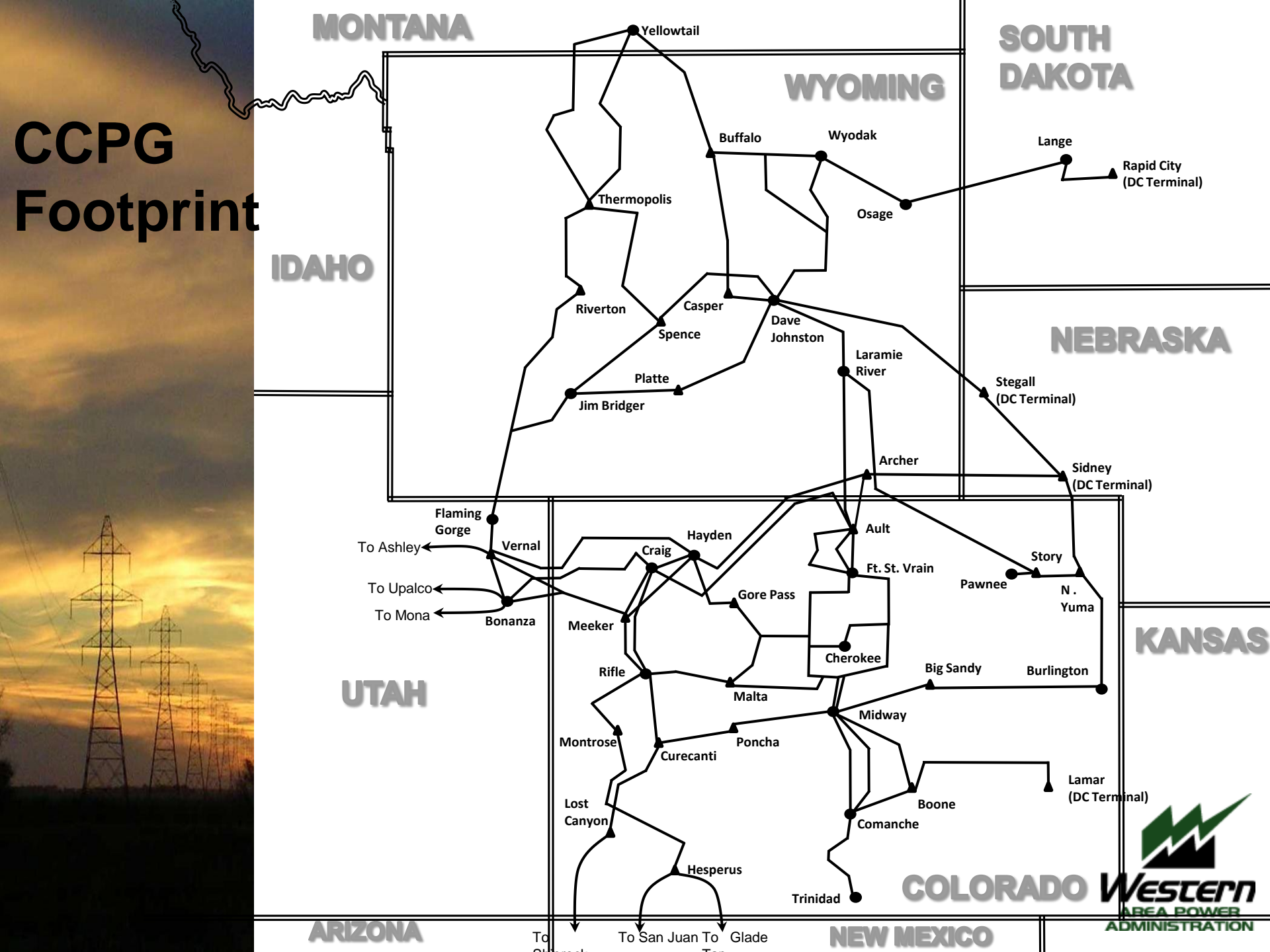
CCPG

➤ Colorado Coordinated Planning Group

■ Eight Member Utilities

- Basin Electric Power Cooperative
- Black Hills Corporation
- Colorado Springs Utilities
- PacifiCorp
- Platte River Power Authority
- Public Service Company of Colorado (Xcel Energy)
- Tri-State Generation & Transmission Assoc.
- Western Area Power Administration-RMR

CCPG Footprint



2010 NERC/WECC Compliance Report

- Performed Annually
 - Begin Base Case Updates in March; Complete in December
- Area Studied
 - Colorado
 - Wyoming
 - Western Nebraska
 - Western South Dakota

Purpose

- Evaluate the steady state post-contingency response of the Integrated System
- Evaluate transient and voltage stability
- Identify problem areas due to system load growth
- Corroborate 10-Yr Network Load Study Findings and Inclusion in CIP
- Meet NERC/WECC Transmission Planning Standards – Auditable documentation

Study Procedure

- Cases Examined
 - 2015 Heavy Winter
 - 2016 Light Autumn
 - 2021 Heavy Winter
- System Intact Criteria
 - 100% Continuous Rating Loading
 - 0.95 p.u. – 1.05 p.u. Voltage
- Contingency Analysis Criteria
 - 100% Continuous/Emergency Rating Loading
 - 0.90 p.u. – 1.10 p.u. Voltage

Transmission Planning Workshop

2011 RMR 10-Year Capital Investment Plan

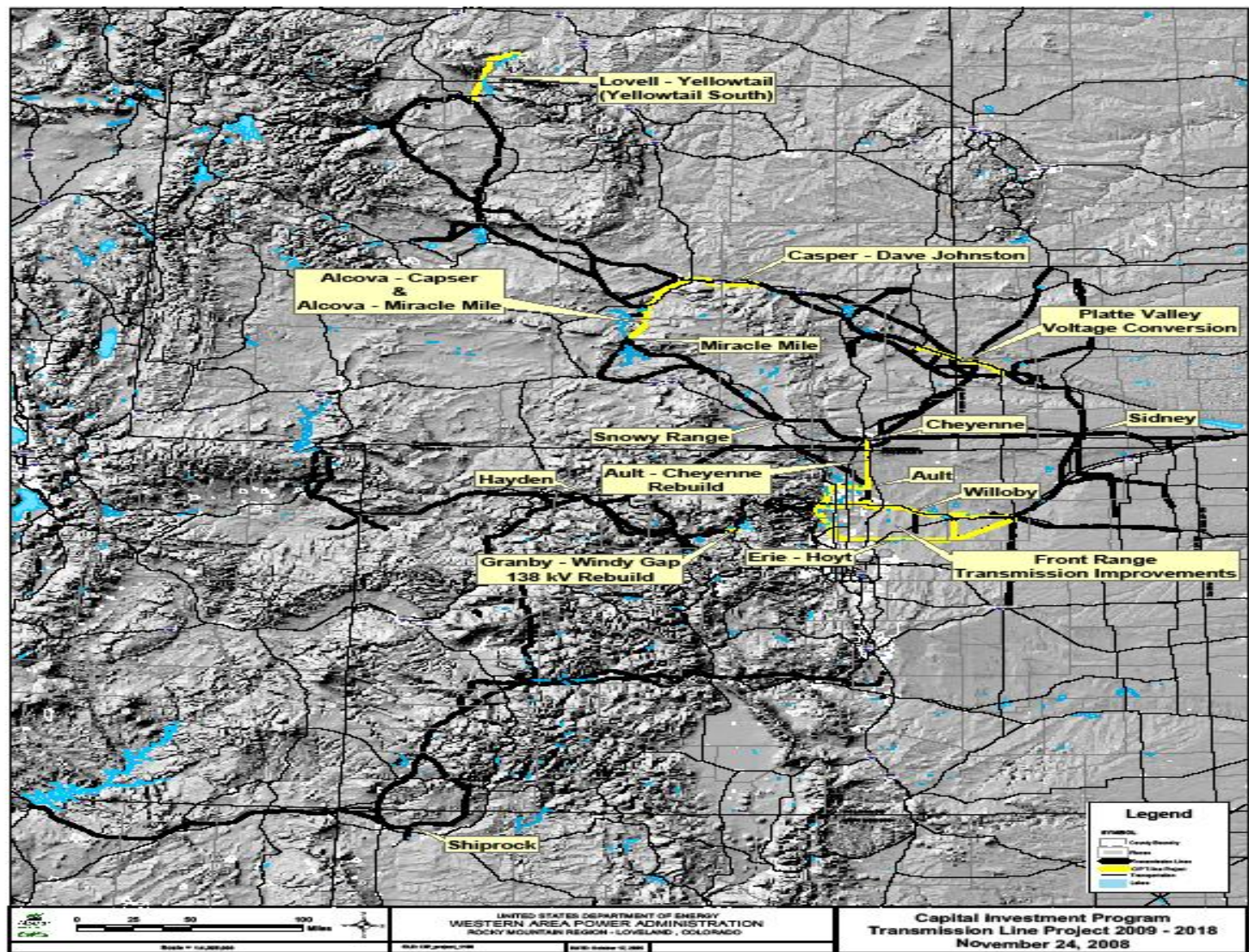
RMR Transmission Planning North
Loveland, CO

June 21, 2011



Purpose

- Communicate capital investment projects related to RMR's transmission system identified within the next ten years to internal and external customers.
- Identify problem areas due to system conditions and projected system load growth.
- Provides a mechanism for customer collaboration and input into capital investment projects.



Major Transmission Line Projects

- Central Wyoming Transmission Project (CWTIP)
- Platte Valley Voltage Conversion Project (PVVC)
- Granby-Windy Gap 69-kV Rebuild
- Estes-Flatiron 115-kV Rebuild
- Lovell-Basin 115-kV Upgrade
- Lovell-Yellowtail #1 & #2 115-kV Rebuild - Phase 1
- Lovell-Yellowtail #1 & #2 115-kV Rebuild - Phase 2
- Lovell-Yellowtail #1 & #2 115-kV Rebuild - Phase 3
- Dixon Creek – Horsetooth Tap 115-kV Rebuild
- Longmont NW – Fordham 115-kV Rebuild
- Craig-Rifle 230-kV Line Upgrade

Major Substation and Transformer Projects

- Ault -Stage 07 – 230/115-kV transformer addition
- Weld-Stage 04 –230/115-kV transformer addition
- Cheyenne-Stage 04 - 230/115-kV transformer addition
- Willoby Switchyard 115-kV
- 115-kV Shunt Capacitor Banks at Fort Morgan West, Frenchman Creek, Sidney Substations
- Stegall KV1A transformer replacement
- Hayden KZ1A Transformer Replacement
- Hayden KZ2A Transformer Replacement
- Curecanti KZ2A Transformer Addition
- Flaming Gorge KY2B Transformer Replacement
- Shiprock Tri-State Interconnection

Central WY Transmission Improvement Project

- **Scope:** A six phase project in Central Wyoming to rebuild several 115-kV lines to address reliability and condition due to age of the lines.
 - Phase I : Alcova-Miracle Mile West 115-kV transmission line. Scope to rebuild 24 miles. ISD planned for 2016.
 - Phase II : Alcova-Casper South 115-kV transmission line. Scope to rebuild 29 miles. ISD planned for 2017.
 - Phase III: Casper-Glendo South 115-kV transmission line. Scope to rebuild 28 miles. ISD planned for 2018.
 - Phase IV: Casper-Glendo North 115-kV transmission line. Scope to rebuild 36 miles. ISD planned for 2019.
 - Phase V : Alcova-Casper North 115-kV transmission line. Scope to rebuild 29 miles. ISD planned for 2020.
 - Phase VI : Alcova- Miracle Mile East 115-kV transmission line. Scope to rebuild 24 miles. ISD planned for 2021.
- **Cost Estimate:** \$82M

Platte Valley Voltage Conversion

- **Scope:** Project located in eastern Wyoming and western Nebraska to convert segments of 34.5-kV line to 69-kV operations:
 - East Morrill Tap – Sievers Rural Tap 69-kV Line. Construct 11 miles of new 69-kV line.
 - Sievers Rural Tap: Install a 69/34.5-kV 25 MVA transformer and associated equipment.
 - Lingle Substation: Install a 115/69-kV 40 MVA transformer and associated equipment.
 - Torrington Substation: Install a 69/34.5-kV 50 MVA transformer and associated equipment.
- **Status:** Project Plan development
- **Cost Estimate:** \$20M
- **ISD:** 2015

Granby Pumping Plant - Windy Gap 69-kV Rebuild

- **Scope:** Rebuild an old 69-kV line to new 138-kV double circuit line.
 - Joint project with Tri-State G&T.
 - Rebuild due to age, condition and system reliability.
 - Improve the ROW.
 - Improve maintenance access to structures.
 - Length is approximately 12 miles.
- **Status:** Environmental Impact Statement process
 - Public Process: December 2011
 - Record of Decision for EIS: March 2012
- **Cost Estimate:** \$13M
- **ISD:** FY14

Estes - Flatiron 115-kV Rebuild

- **Scope:** Rebuild the two 115-kV lines between the Estes and Flatiron Switchyards.
 - Rebuild due to age and condition.
 - Improve the ROW to help with vegetation management criteria.
 - Improve maintenance access to structures.
 - Length is approximately 16 miles.
 - Result will be new double circuit 115-kV line to replace 2 wood H-frame lines.
- **Status:** Environmental clearance process
- **Cost Estimate:** \$19M
- **ISD:** 2014

Lovell – Basin 115-kV Uprate

- **Scope:** Project to uprate segments of the Lovell - Basin 115-kV line
 - Approximately 40 miles
 - Re-conductor the line with 477 ACSS conductor.
- **Status:** Environmental Clearance and Design
- **Cost Estimate:** \$3M
- **ISD:** 2013

Lovell – Yellowtail No. 1 & 2 115-kV Rebuilds

- **Scope:** Phased project to rebuild the Lovell – Yellowtail No. 1 & 2 115-kV lines.
 - Initiated due to age and condition.
 - 115-kV construction with wood structures and 795 ACSS conductor.
 - Each line rating will be 330 MW.
 - Each line is 47 miles long.
 - Phase 1 – Segments on National Park Service land
 - Phase 2 – Segments on Private Property
 - Phase 3 – Segments on Crow Reservation
 - Increases capacity across Yellowtail South constraint path for sufficient capacity to carry entire Yellowtail generation on either line.
- **Status:** Environmental Clearance and Design
- **Cost Estimate:** \$39M
- **ISD:** 2014

Front Range Transmission Improvements

- Dixon Creek Substation – Horsetooth Tap 115-kV Rebuild
 - Joint Project with Platte River Power Auth.
 - Replace 115-kV wood H-frame with 230-kV single pole steel double circuit line.
 - **Status:** Design and Construction Planning
 - **ISD:** January 2012
- Longmont NW – Fordham 115-kV rebuild
 - Joint Project with Platte River Power Auth.
 - Replace 115-kV wood H-frame with 230-kV underground double circuit line.
 - **Status:** Under construction
 - **ISD:** Summer 2011

Craig-Rifle 230-kV Uprate

- **Scope:** Increase line rating to a minimum of 1600 amps. Requires reconductoring segments of the line and replacing limiting equipment at each terminal.
 - Rifle: Replace six 230-kV disconnect switches and jumpers
 - Craig - Replace CT's
 - Re-conductor four spans of line into Rifle and two spans into Craig with 1272 ACSS
- **Cost Estimate:** \$1,850k
- **ISD:** 2012

Substation and Transformer Projects

- Ault Stage 07
 - **Scope:** New 230/115-kV, 200 MVA transformer with associated substation additions.
 - **Status:** Transformer ordered, under construction
 - **Estimated Costs:** \$6.5M
 - **ISD:** 2012

- Weld Stage 04
 - **Scope:** Install 3rd 230/115-kV 150 MVA transformer and associated substation additions. Joint project with Public Service of Colorado
 - **Status:** Transformer ordered, under design
 - **Estimated costs:** \$5M
 - **ISD:** 2012

Substation and Transformer Projects

- Cheyenne Stage 04
 - **Scope:** Install 2nd 230/115-kV 200 MVA transformer and associated substation additions.
 - **Status:** Project Plan and pre-design
 - **Cost Estimate:** \$5M
 - **ISD:** 2014

- Willoby Switchyard
 - **Scope:** New “greenfield” substation to sectionalize a tap on the Kiowa Creek – Weld 115-kV line.
 - 3 breaker ring bus configuration
 - **Status:** Construction contract solicitation
 - **Cost Estimate:** \$5M
 - **ISD:** 2012

Substation and Transformer Projects

- 115-kV Shunt Capacitor Banks Additions
 - **Scope:** Install 115-kV shunt capacitor banks at Fort Morgan West, Frenchman Creek and Sidney Substations. Project is needed to retain TOT3 Transfer Capabilities.
 - **Status:** Under construction
 - **Cost Estimate:** \$3.5M
 - **ISD:** 2012
- Stegall KV1A transformer replacement
 - **Scope:** Replace transformer KV1A with new 230/115-kV, 200 MVA unit. Addresses transformer overload conditions being seen in near future load studies.
 - **Status:** Planning
 - **Cost Estimate:** \$7M
 - **ISD:** 2016

Substation and Transformer Projects

- Hayden Transformer KZ1A Replacement
 - **Scope:** Replace failed transformer KZ1A with new 230/138-kV, 250 MVA unit
 - **Status:** Under construction
 - **Cost Estimate:** \$3.5M
 - **ISD:** 2011
- Hayden Transformer KZ2A Replacement
 - **Scope:** Replace transformer KZ2A with new 230/138-kV, 250 MVA unit and add necessary substation additions to allow independent protection and operations.
 - **Status:** Project Planning
 - **Cost Estimate:** \$7M
 - **ISD:** 2013

Substation and Transformer Projects

- Curecanti KZ2A Transformer Addition
 - **Scope:** Install second transformer and necessary substation additions. Redundant 230/115-kV connection needed for reliability purposes.
 - **Status:** Planning
 - **Cost Estimate:** \$5M
 - **ISD:** 2016
- Flaming Gorge KY2B Transformer Replacement
 - **Scope:** Replace transformer KY2B with new 230/138-kV, 250 MVA unit.
 - **Status:** Planning
 - **Cost Estimate:** \$5.5M
 - **ISD:** 2018

Substation and Transformer Projects

- Shiprock Interconnection for Tri-State's San Juan Major Project
 - **Scope:** Add necessary 230-kV additions for interconnection of two new 230-kV lines.
 - **Status:** Environmental Clearance
 - **Cost Estimate:** \$7M
 - **ISD:** 2014

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